

these might even be considered as a single natural genus. But to such as study the Mollusca of a larger and more prolific district, and especially the species now contained in collections brought from various climes, such a union of genera seems to me most undesirable, particularly as it prevents that accuracy of observation and discrimination which it is the great advantage of natural history as a branch of education to establish and teach.

“From the study of the animals, shells and opercula of these Lamarckian genera, I have been induced to form the group into the following families, viz. *Rotelladæ*, *Turbinidæ*, *Liotiadæ*, *Trochidæ*, *Stomatelladæ*, *Scissurelladæ*, *Haliotidæ* and *Fissurelladæ*. I believe that *Scissurella* is very distinct from *Trochus*, and intermediate between it and the *Haliotidæ*, but more nearly related to the latter than the former; and this view of its position has been strengthened by Mr. Barrett’s description of the animal, as well as by what you say as to the operculum and structure of the shell.

“Though the family of *Scissurelladæ* only contains one, or as you have very properly proposed, two genera, yet they appear to be all that remain of a large number of fossil genera, containing together more than 300 well described and figured species.

“I never believed that *Scissurella* had any relation with *Ianthina*, and the figure and description of the animal distinctly prove that it has not any.

“*Adeorbis*, on the other hand, is clearly a genus belonging to the same great group above mentioned, and is referable, by the exquisite structure of its operculum, to the family *Liotiadæ*, characterized by its horny many-whorled operculum being ornamented with concentric spiral lines of a calcareous pearly substance.

“Ever yours sincerely,
 “J. Gwyn Jeffreys, Esq.” “J. E. GRAY.”

XXVII.—*On the House Ant of Madeira.* By Prof. O. HEER, of Zurich. Translated from the original by R. T. LOWE, M.A.

[Concluded from p. 224.]

II. Description of the House Ant.

ÆCOPHTHORA, Heer.

MANDIBLES very strong, in the females and soldiers with a sharp cutting edge, in the labourers toothed like a saw. Palpi of the tongue and maxillæ very short and two-jointed; the

second joint somewhat longer than the first. The pergamentaceous stalk or stipes of the maxillæ with a thin membranous, ciliated sheath (case or cover).

Antennæ in the males seventeen-jointed, the first joint thicker but not longer than the next succeeding joints; in the females, labourers, and soldiers twelve-jointed, with a rather long shaft and eleven-jointed flagellum, the three last joints of which form a slight, gradually attenuated club.

Wings with three cubital and two discoidal cells; *the middle cubital cell stipitate.*

The tibia in the females, labourers, and soldiers with a pectinate hook.

The back of the metathorax with spines.

The abdominal pedicle two-jointed, the first joint clavate.

The family consists of males, females, labourers, and large-headed soldiers.

This genus belongs to the group *Myrmicidæ*; it differs altogether from *Myrmica*, Latr., by the much shorter two-jointed palpi, by the seventeen-jointed antennæ in the males, and the venation of the wings; in this last point it approaches nearer the genus *Atta*, but in this the maxillary palpi are five-jointed, and the metathorax is unarmed with spines. In the two-jointed palpi our genus agrees with *Pheidole* and *Typhlopone*, Westw.; the latter genus belongs to the group *Poneridæ*, and cannot therefore come into consideration; the former is founded by Westwood on an Indian species, the *Atta providens*, Sykes; but from this, *Ecophthora* differs in the much longer first joint of the tarsus, the anteriorly sharper-toothed mandibles, the maxillary-case produced beneath, by the fusiform second joint of the maxillary palpi, the much less deeply notched upper lip, the differently shaped abdominal pedicle, and the marked division of the neuters into two forms, widely differing in the structure of the head.

Ecophthora pusilla, Heer.

Allied species to it are the *Myrmica omnivora*, L. Latr., *Myrmica nana*, Latr., and *Atta megacephala*, F. Latr., both the latter of which must certainly belong to the genus *Ecophthora*. The *Myrmica omnivora*, Latr., is spread over all tropical America, and also appears in Egypt as one of the pests of the country. More recently it has also spread northwards, and in Kasan as in London does great mischief in houses. From this *M. omnivora*, our Madeira kind is distinguished (over and above the generic characters) by the armed thorax, and by not having both the segments of the node or abdominal pedicle (die beiden Glieder des Knötchens) cylindrical. With the *Myrmica nana*,

Latr. (*Formica pusilla*, De Geer, from South America), it agrees in size, colour, and the armed thorax; but in that, the thorax, with the head, is shagreened with numerous little raised points, which is not the case in our species. In the form and size of the head, the soldier of the *Ecophthora* agrees with the *Atta megacephala*, Latr. (from the Isle of France); yet Latreille would surely not have overlooked the peculiar striated sculpture of the head: but since neither the description nor figure gives this, we cannot identify our species with his; and this especially as the female is said to be only a little larger than the neuters,—the difference in ours being so considerable. From this, *A. megacephala*, Latr., the ant so called by Losana (Memorie della Reale Accademia di Torino, xxxvii. p. 328), is distinct; and the description of the species which is found in the gardens of Piedmont agrees in all points of importance with the soldier of the Madeiran ant. On the other hand, the description of the labourer is quite inapplicable, for it assigns to it a larger heart-shaped head. It is also very surprising that Losana should not have remarked that the head of the labourer is quite smooth, and that labourers and soldiers present constant differences, not only in size, but also in the formation of the head.

1. *The Female.*

Pl. III. fig. 1. 1, the natural size; fig. 1. 2, ten times magnified; fig. 1. 3, in profile.

Whole length $3\frac{1}{4}$ lines. Length of the head $\frac{3}{4}$ line, breadth the same. Length of the thorax 1 line, breadth $\frac{3}{4}$ line. Length of the abdomen $1\frac{1}{2}$ line, breadth nearly 1 line. Length of the upper wings $3\frac{1}{4}$ lines, breadth $1\frac{1}{8}$ line.

The head is roundish, and of the breadth of the thorax, as long as broad, with a very slight notch at the base behind. The eyes are rather small, and composed of few lenses. The three ocelli are very distinct, and placed at the base of the head in a triangle. The clypeus is not distinct from the forehead; slightly hollowed out directly over the mouth, where the edge is furnished with a row of punctures. The antennary clefts are somewhat converging forwards, short, but broad and deep, and rather widening forwards, where the forehead, which otherwise is flat, becomes more prominent. The forehead between the antennary clefts is moderately broad, and furnished at its anterior margin with an impressed, triangular, somewhat smoother compartment, which is faintly keeled down the middle. The whole upper side of the head is traversed by fine parallel striæ longitudinally, which reach down nearly to the base of the head; behind the eyes the striæ are fainter, more irregular, and partly obsolete, or passing into

dots. The upper lip (labrum) (fig. I. 4) is very small, and depends quite perpendicularly between the mandibles; it consists of two horny plates, a very short but broad basal piece, and a second longer outer piece, which is rounded, and slightly notched anteriorly; in the middle of the notch stands a little papilla. The labrum is beset with a double row of fine bristles, one within the other upon the edge, with two longer, stouter bristles in the centre of the lip. The mandibles (fig. I. 5) are very strong and horny, becoming broader and hatchet-shaped externally; the fore-edge exactly truncate, and produced forwards into a strong tooth, furnished with a narrow horny rim or border extending at the top into a short, not prominent, tooth. This border, which, as the actual cutting-edge, forms the mandibles, is very sharp, but without teeth. The outer edge of the mandible is grooved; the upper surface, on the contrary, even. The maxilla is much smaller. The peduncle (stipes) is pergamentaceous, narrowed at the base, notched at the top, to which is affixed the extremely small two-jointed *palpus*: this is so small, that it does not reach to the point of the sheath. The first joint is cylindric, the second somewhat longer, fusiform, and produced into a fine point. The sheath extends pretty far out beyond the stipes; it consists of a stalk-like basal piece (fig. III. 5. *b*³) and a larger membranous very thin upper piece, which is rounded at top and furnished with a crown of hairs; further below the hairs cease, and the edge is naked and extremely thin; but here a border of excessively minute hairs runs obliquely over the surface of the sheath. The labium is very small, as long as the stipes of the maxilla, greatly narrowed at the base, broader outwards and bluntly rounded. The lingual palpi are two-jointed and very short; the first joint obconic, the second fusiform and somewhat longer, bearing two bristles. The mentum is corneous, and slightly hollowed out. The antennæ are moderately long; the first joint (the scape) extends a little beyond the edge of the head, and is scarcely perceptibly thickened outwards: the flagellum is eleven-jointed; its first joint is about twice as long as the next very short one; all are of equal thickness; the three last are considerably larger, though not abruptly distinct from the rest; they are together about the length of the seven preceding joints. All the joints of the flagellum are finely hairy, especially the last three.

The thorax is pretty large. The *prothorax* is very short, and not perceptible from above; laterally, however, the side-piece (Pl. III. fig. I. 3 *a*²) forms a pretty broad prominent segment; the *mesothorax* composes the chief part of the thorax (fig. I. 3 *b*); the *mesonotum* is somewhat larger than the head, rather flat above, nearly circular, but truncate behind, with a transverse impression and row of impressed punctures, and on either side a

small black tubercle. The upper side of the mesonotum is quite even, with only a faint longitudinal groove. The scutellum (fig. 1. 3 *b*²) is attached immediately to the mesonotum; it is abruptly truncate in front, bluntly rounded behind. The side-plate of the middle thoracic segment is of about the same size as that of the anterior, and receives the coxa of the middle leg. The first piece of the metanotum is extremely short (fig. 1. 3 *c*¹); the second piece (its *scutellum*, fig. 1. 3 *c*²) is indeed longer, but still small and strongly attenuated backwards. On the back it is even; on each side bordered by a raised margin, on which stands a distinct prominent black spinule.

The legs are moderately long, with thick but short coxæ, small trochanters, and femora dilated in the middle. The tibia is considerably shorter than the femur. The anterior tibia is thickest in the middle, slightly rounded forwards on the inner side, where there is placed a moveable proportionably large hook, furnished on its inner side with a membranous border, which is fringed with a row of fine straight setæ (fig. 1. 6 *c*), giving it the appearance of a comb. The tarsi are long, and extremely slender and filiform. The first joint is nearly as long as the tibia, but the four following are very short. The fifth is thickened outwards, and provided with two curved very sharp claws (fig. 1. 7), between which lies a membranous flap (or lobe). The first tarsal joint in the four hinder legs is straight, but in the anterior pair is very strongly curved at the base, the curve answering to the pectiniform hook, which has a similar curvature. It is also worth notice, that on the parts of the tarsus answering to the hook, the tarsus is clothed with a thick fine felt of hairs; whilst on the other parts of the tarsus, these hairs are longer and less closely set.

The wings extend pretty far beyond the apex of the abdomen. The fore-wings are much narrowed at the base, and attain their greatest breadth at three-fourths of their length. They have a distinct, pretty large stigma. The radial cell, before it, is open, for the *vena scapularis* does not run into the margin. The cubital cells are three, of a similar form to those of the *Atta*. The inner cubital cell is polygonal and irregular; it is contiguous to the stigma: the second is also closed, somewhat bell-shaped and pedunculate; the cross vein which divides it from the third open large cubital cell is connected with the cross-vein which divides the inner cubital cell from the radial cell, and which issues from the stigma. The inner discoidal cell is rhomboidal and rather small; but the outer discoidal cell is very large and open. The *area interno-media* is divided into two cells, of which the outer one is open, the *vena interno-media* running out free. The hind-wings are considerably smaller than the fore, and the *vena scapularis* is connected already at one-third

of their length with the marginal vein; the *v. externo-media* divides very soon into two forks, the outer of which is connected by a little cross veinlet with the scapular vein, and then proceeds towards the tip of the wing. The *v. interno-media* is extremely short, and opens into the *externo-media*.

The abdomen consists of six segments, the first two of which form a proportionably long pedicle. Of this the first segment is strongly curved like a horn, and clavate. At the point of its insertion into the thorax it is quite thin, but is thickened upwards. This thin pedicle is the cause of the great mobility of the abdomen: when raised perpendicularly up, it shuts on so close to the metathorax (cf. fig. 1. 2), that from above only its nearly quadrangular head (*i. e.* the upper end) is visible; but when lowered, its head separates from the metathorax in proportion to the obliquity of its position (cf. fig. 1. 3). When the pedicle is raised, the abdomen is lifted up aloft; in the other case it is depressed. The second joint of the node* (the second abdominal segment) is much broader, but much shorter, inserted obliquely into the first, and, seen from above, coroniform. On either side it is furnished with a small tuft of hairs. The body of the abdomen consists of four segments, and is shortly oval, somewhat broader than the head, bluntly rounded before and behind. The first segment, or third of the whole abdomen, is the largest; it is of the same length as the three following together. It is even; only furnished on the back with a faint longitudinal line, and on the hinder edge with a row of punctures and a circlet of hairs; the upper side is pretty thickly clothed with fine short pubescence. The second segment is decidedly shorter, quite smooth and naked, with only a narrow hairy band on the hinder edge, and the edge itself ciliated with longer hairs. The third and still shorter segment presents the same characters; the fourth only projects a very little.

The colour of the insect is a shining brown. The head is chestnut-brown; the fore part lighter, yellow-brown; the edge of the scutum and the fore-edge of the mandibles black. The eyes black, the ocelli whitish. The mesonotum is of the same colour as the head; the metanotum, on the contrary, lighter yellow-brown; the tibiæ and femora are brown, the tarsi and antennæ light yellow. The abdomen is shining; lighter in front, behind blackish-brown: the commencement of the first segment, and sometimes the (whole) first segment and fore-part of the second of the body of the abdomen are yellow-brown; the hinder segment, on the other hand, is dark brown or blackish; but the small last (segment) again lighter yellow-brown. In certain individuals, moreover, the whole body is a lighter brown

* Knötchen—here evidently means pedicle.—Tr.

than in the majority. The wings are hyaline, whitish, with yellowish veins.

2. The Male.

Fig. II. magnified ten times. As before mentioned, I found only a single example, which was moreover broken to pieces on the journey, the head and thorax only remaining perfect. In fig. II. 1, the dotted portion (the abdomen) is sketched merely from memory.

Length of the head $\frac{1}{4}$ of a line; of the thorax $\frac{5}{8}$; breadth of the same $\frac{1}{2}$ a line.

It is much smaller than the female, the length of the soldier, and of a coal-black colour; the legs only are light yellow, with however the coxæ and trochanters black. The head is small and nearly circular; its mandibles are small, scarcely perceptible; the palpi, on the other hand, are somewhat longer than in the female. The head is smooth, bearing in front the approximate antennæ; these are long, setaceous, and seventeen-jointed. The first joint is the thickest, the second of the same length, as also the 7-8 following; but thence they become gradually shorter, and more abruptly separated from each other; whence the last seven joints can be much more easily distinguished from one another than the first ten. All the joints (with the exception of the first and last) are cylindrical and thickly pubescent. The thorax is considerably broader than the head, bluntly rounded anteriorly; the hinder edge of the mesonotum with a row of longitudinal excavations; the scutellum subtriangular, its edge also beset with impressed punctures; the abdomen oval. In the wings, the inner discoidal cell is larger than in the females. The legs are of finer make than in the females. The femur is thinner, the tibia proportionally longer (fig. II. 2). The hook at the fore part of the tibia (cf. fig. II. 3) is differently formed; it is curved, and also furnished on the inner side with a row of setæ, which are not however attached to a membranous flap (hautlappen*), and are not pectinate. The tarsus is much shorter than in the female; the first joint about the length of the second and third together; the second, third and fourth are of equal length; the fifth is thickened outwards, and with two sharp claws.

3. The Labourer.

Fig. IV.—IV. 1, the size of nature; IV. 2, magnified ten times.

Whole length $1\frac{1}{8}$ line; length of head $\frac{3}{8}$ line; breadth the same; length of thorax $\frac{1}{2}$ line, of abdomen $\frac{1}{4}$ line.

* "Hautrande" (membranous border) before, in description of the female.—TR.

The head is somewhat larger than the abdomen ; it is altogether shining, smooth, and naked. The point of insertion of the antennæ is also marked by a pretty deep groove, and the anterior border of the forehead likewise furnished with an impression ; on the other hand, the striæ, which in the females as well as in the soldiers are perceived on the head, are wholly wanting. The mandibles (fig. iv. 3) are proportionably longer, but more attenuated at the base than in the female and soldier, acquiring thus a more slender form ; the two teeth at the point are longer and much more acute, and the whole inner edge is set with a row of little teeth, varying in number between ten and twelve. These teeth are very regularly placed, and give a serrated appearance to the edge of the mandible. The teeth of both mandibles fit into each other, and make it intelligible how these little animals can hold and carry with their mandibles such considerable loads. The other parts of the mouth are formed as in the female. The antennæ (fig. iv. 4) are much longer in proportion than in the female and soldier ; their shaft or pedicle extends conspicuously beyond the head, their base ; in other respects their structure is the same. The ocelli are wanting.

The thorax is very narrow ; the prothorax (the collar) is very finely granulated. The mesothorax is somewhat widened in the middle ; it is quite smooth and shining ; on the other hand, the scutellum and the metathorax are very finely granulated (only perceptible under the microscope), the latter furnished on each side with a small spine.

The legs are formed like those of the female, only much smaller (fig. iv. 5, 7) ; their tarsi are extremely fine, with however sharp claws, between which is seen a membranous lobe (fig. iv. 6). They are finely pubescent.

The second joint of the abdominal pedicle is proportionably longer and more slender than in the female ; the abdomen itself very small and shortly oval. The first segment is about half the length of the whole, and is also much greater than the second.

The head is sometimes lighter, sometimes darker brown ; the thorax, shaft of the antennæ, femur and tibia light yellow-brown ; the flagellum of the antennæ and the tarsi light yellow. The shining abdomen chestnut-brown, lighter at the base and tip.

4. *The Soldier.*

Fig. III. 1, natural size ; fig. III. 2 & 3, magnified ten times.

Whole length 2 lines ; length of head $\frac{3}{4}$ of a line, breadth full $\frac{5}{8}$ line. Length of thorax $\frac{3}{4}$ line ; of abdomen $\frac{1}{2}$ line, breadth the same.

Distinguished from the labourers by the head being twice as

large, emarginate at the base and striated, by the shorter and stronger mandibles, which are not toothed on their inner edge, and by the somewhat larger abdomen.

The faintly pubescent head is of enormous size, and much more deeply emarginate at the base than in the female, so that it is nearly heart-shaped. A deep longitudinal furrow traverses it in the middle. The antennal clefts are pretty deep, being bordered anteriorly and towards the forehead by a rather strong prominent rim. The fore-part of the forehead has a deep impression like that of the female. The clypeus is very short, and divided from the head by a faint line. The upper side of the head is finely striated longitudinally, as in the female; these striæ become obsolete behind the middle of the head, so that its hinder part is quite smooth. The eyes are small, and the ocelli are wanting. The trophi are as in the female, as are also the mandibles, except that on their cutting edge stands a pair of very small obtuse denticles furnished with a bristle (fig. III. 4). The antennæ are as in the females; their shaft is much shorter than the head; the three last joints (fig. III. 6, 7) are distinctly separate.

The thorax is similarly formed as in the labourer, except that the mesothorax is much broader in the middle and bears on each side a little tubercle (Härchen) furnished with a bristle, by which structure it is distinguished both from the female and labourer. The scutellum is almost quadrangular; the hinder piece of the metanotum is armed on each side with a sharp spinule, and furnished in the middle with a longitudinal cleft. The whole thorax is sprinkled with scattered or distinct hairs. The legs are larger than in the labourer; otherwise they are of the same form.

The abdomen is much smaller than the head. The first joint of the pedicle is enlarged into a more prominent scale-like protuberance (furnished with a tuft of hairs) than in the labourer; the second joint, on the other hand, is shorter and thicker than in these, and approaches in form that of the female. The first segment of the abdomen is the largest; the second of about the same breadth, but shorter; the third rounded behind; the fourth is very small, and almost withdrawn into the preceding. It is quite smooth and shining, sparingly sprinkled with fine bristles, which at the hinder edge of each segment are longer and set closer together.

The head is sometimes lighter, sometimes darker brown; on the under side always lighter than on the upper. The edge of the clypeus and the anterior edge of the mandibles black; the antennæ and legs are light yellow; the thorax and abdominal pedicle somewhat lighter brown than the head; the abdomen at the base and tip of the same colour; the second and third seg-

ments, on the other hand, blackish-brown. At times the dark brown extends further, over even the hinder edge of the first segment; but still more frequently it is more contracted, forming only a dark band over the hinder edge of the second and the (whole of the) third segment.

III. Conclusion.

Comparing with each other these four different kinds which compose a colony of *Ecophthoræ*, we find that the males differ altogether from the rest in the structure of the head. The females, soldiers, and labourers approach each other closely in the structure of the parts of the mouth, in the legs, and in the equal number of the abdominal segments; yet the labourer differs much from the female, not only in being so much smaller, but by its smooth head, its serrato-dentate mandibles, different structure of the thorax, owing to the want of wings, as well as by the form of the second joint of the abdominal pedicle. In size, structure of the mandibles, and striated head, the soldier forms a middle link between the female and the labourer; but, on the other hand again, it differs much from both in its excessively large perfectly heart-shaped head, and in the shape of the mesothorax; assuming thus quite a peculiar aspect. These forms are very distinctly marked; and amongst the numberless specimens seen by me of this ant, no intermediate link between the labourer and soldier ever has occurred. In *Atta capitata*, Latr., which I have observed in great numbers on the Guadalquivir at Seville, as well as in several other places in Spain, labourers with small heads, and soldiers with large, occur also; but, between these, transitional forms are found, which is never the case with our *Ecophthora*. That the soldiers cannot possibly be slaves captured from other nests (a circumstance of known occurrence amongst the Amazon-ants), is proved as well by their very constant occurrence in the pupa and perfect state in the nests of the *Ecophthoræ*, whilst they are never found alone, as by their agreement in all essential organs (in their trophi, antennæ, and legs) with the labourers and females. Such a marked distinction between the two neuter forms as in *Ecophthora* has not elsewhere been observed. Something similar, however, seems to be the case in several species of the Southern Hemisphere, only it has not usually been rightly understood. We have seen above, that in the Train and Driver Ants two forms of neuters are found, and also in *Atta capitata*, Latr., which must not be considered as varieties, but as forms, each of which has its own special and peculiar position in the ant-æconomy. Nay, even amongst several of our own species, attentive observation points

out two forms of labourers ; for example, in *Formica herculeana*, L., and *F. pubescens*, F. ; only the difference is not so striking as in the above-cited species. The same too with the Honey-bee ; for in the same hive smaller and somewhat bigger labourers are found, of which, according to Huber, the former take care of the brood, the latter produce the wax.

At present it is generally held, that the neuters found amongst all these insects which live together in large families are imperfectly developed females ; and one would be led to this view principally by the resemblance of the working-bees to the females (the so-called queens), as well as by the fact, deduced from certain experiments carried on with bees, that in many cases they can make queens out of working-bees' eggs. When indeed a comb full of eggs is introduced from another hive into one without a queen, this last can *sometimes* rear itself a new queen out of it ; but this by no means always happens, and I have myself twice employed this method without any result, which shows that queens cannot certainly be reared from *all eggs* laid in the cells of working-bees. Amongst bees the labourer indeed is very like the queen ; but with ants the difference is very great : in these, not only are the females much larger and winged, but they have an essentially differently formed thorax ; so that it seems quite incomprehensible to me that merely the mode of nutriment should determine such different kinds of individuals, and that it should depend on the labourers whether a female or a labourer should proceed from the same egg. But the explanation is rendered still more difficult by the occurrence of a second form of neuters, differing again as much from the females as from the labourers. In this case we must therefore hold, that ants possess the means of rearing labourers out of some and soldiers out of other eggs,—which appears to us very improbable. Hence we are almost compelled to ascribe the distinction between the females, labourers, and soldiers, not to the skill of the ants in rearing them, but to an original difference ; and consequently to admit, that not only in the male and female individuals, but also in the labourers and soldiers, the difference is congenital. This is borne out by the fact that bifurmed individuals, between labourers and males (cf. *Entomologische Zeit.* 1851, p. 295), have already been discovered, in which one half exactly represents the male, the other half the labourer ; precisely like bisexual individuals in insects, between male and female. Were the neuters undeveloped females, we should not meet with forms like these, but we should rather have forms of transition between neuters and females, which however is never the case. Against this view it may be alleged, I am well aware, that in the animal kingdom only two constantly

